Fall 1953

JOHN K. SELLECK, Alpha
Named Acting NU Chancellor
University's Business Manager Picked As Temporary Successor To Gustavson

The University of Nebraska Board of Regents unanimously named John K. Selleck acting chancellor of the university late Monday afternoon.

Mr. Selleck, an administrative staff member of 32 years, is now general business manager of the university. He will assume the duties of the chancellorship when Dr. R. G. Gustavson, chancellor since September, 1946, leaves the office, probably in mid-July, to become president of Resources for the Future, Inc.

The selection of Mr. Selleck was in keeping with a unanimous recommendation from a special committee authorized by the university senate to speak for the faculty.

"To be asked to serve as acting chancellor of the University of Nebraska," Mr. Selleck said, "is, I think, a great honor and responsibility even if for a tenure of only a few weeks.

"I am, of course, very grateful for the confidence that has been manifested in me by the Board of Regents, and by the faculty itself. My service to the university has always been on the business side of the institution and I am especially pleased, therefore, that I should receive this expression of confidence from our academic staff.

"I am sure that I express the sentiments of all of us at the University when I say that I hope that within a very short time an educational leader will be found who can be named chancellor."

Mr. Selleck is a native of Lincoln and received a bachelor of science degree in electrical engineering from the University in 1912.

After graduation he went to Chicago as an engineer for the Illuminating Electric Company and served with it until he entered Army service in World War I. After a year and a half in the Army, he returned to the Chicago company but left in 1921 to become assistant purchasing agent for the university.

In 1923 he became business manager for the university's department of intercollegiate athletics. In 1941, he received a telephone call from the then Chancellor C. W. Boucher who asked him to assume the post of comptroller for the university.

"When do you wish me to start?" Mr. Selleck said.

"Now," said the chancellor.

Mr. Selleck picked up his hat, walked from the Coliseum to the administration building and has been there ever since. In 1948, the Board of Regents ordered a reorganization of the university's administrative offices and Mr. Selleck was named general business manager. He has served as corporation secretary for the university since 1941, a position he still holds and which includes the duties of secretary to the Board of Regents.

ENGINEERING AND MANAGEMENT TRENDS IN INDUSTRY

By J. E. Schaefer, Epsilon Chapter

J. E. Schaefer is a vice president of Boeing Airplane Company and general manager of its Wichita Division. A graduate of the United States Military Academy, he was among the first West Pointers to ask for an aviation assignment before graduation. He learned to fly in 1917, became a flight and training officer in the Aviation Signal Corps of the U. S. Army, and first entered commercial aviation in 1928. By his enterprise and energy, he helped his company survive the pioneering days in aviation and the depression years, and later directed Boeing-Wichita's World War II production which totaled 10,346 Kaydet primary trainers and 1,644 B-29 Superfortresses. He now faces an assignment of similar magnitude as head of a team of some 25,000 men and women producing the 6-jet B-47 medium bombers at the rate of about one per working day. Schaefer was initiated as a member of Sigma Tau by the Kansas State College chapter in March, 1952.

J. E. SCHAEFER

Each element of modern industry has a character of its own, and what is said about the engineering and manufacturing trends in one may not and frequently does not apply strictly to another. The comments and observations made here will deal with one of the most dynamic elements of modern industry—aviation. The observations are based on 25 years as an executive in that industry during which time our employ-

ment ranged from a low of 13 at the bottom of the depression to a peak of 29,400 early in World War II. Today it is approximately 25,000.

Like other industries so closely connected with technical progress, aviation has left all its static qualities behind. It is constantly charting new adventures into unknown fields. And in this year, which is the fiftieth anniversary of powered flight, the pace seems even faster as each progressive step opens up new horizons and new fields to explore.

For those engineers who might consider using their talents in aviation, there are four or five factors they may well think about. These are some of the things which mark the 1953 picture as notably different from a decade ago.

In the first place, the products of today are, of necessity, becoming tremendously complex. Today's military airplanes must be designed to fly higher, faster and farther than those of yesterday—I almost said than those of an hour ago so rapid is our progress. Unless they do fly higher, faster and farther they can't get through to selected targets against the constantly advancing defensive techniques the enemy is capable of putting up against them. To accomplish these goals involves engineering design complexities of a "fantastic" order.

As a matter of fact, my company has now spent nearly eight years of design and production work on the B-47 Stratojet, the 6-jet, swept-wing medium bombardment airplane now in production at Wichita. It can be said, in general, that it takes six years to develop a modern bombardment airplane. That was the period required for the famous Boeing B-29—to develop it to full combat effectiveness—and this under full pressure of war with top priorities. But the B-47 is vastly more complex mainly because of its high-altitude, higher-speed requirements and the necessary emphasis on automatic control that such performance characteristics dictate.

To illustrate the make-up of a truly modern aircraft product, here are some facts about the Boeing Stratojet: The total equivalent horsepower of its six jet engines is about 56,000 (at a speed of 600 mph). Compare this with the 6,000 horsepower needed to pull the nation's crack trains across the country. Yet the B-47 has only three crew members, while the B-29 had a crew of ten. Electronic equivalents for these "absent" crew members must be designed into the airplane. These equivalents must appear in extremely compact form because of the high fuel space and capacity requirements of a jet bomber. Also, more room is needed for other military accessories and crew equipment which must be installed in any such high performance plane.

Engineering on the wing of the B-47 is another example of the modern-day complications. It is one thing to fly into turbulent air at 100 or 150 mph. and quite another to hit gusts at 600 mph., which is

Boeing Airplane Company Photo

(B-47 Flight)

This photograph of one of the production models of the Boeing B-47 Stratojet was taken on a recent test flight at Wichita, Kan., where Boeing Airplane Company is building the swept-wing bomber for the U. S. Air Force. The first of the new planes rolled from the assembly line March 1, 1950. The fastest known bomber in the world, the Stratojet has a top speed of more than 600 miles an hour. It is powered by six General Electric turbo-jet engines, has a maximum gross takeoff weight of 185,000 pounds and can carry more than 20,000 pounds of bombs. In 1949, one of the two XB47's spanned the nation from Moses Lake, Wash., to Andrews Air Force Base, Md., in three hours and 46 minutes at an average speed of 607.8 miles an hour.

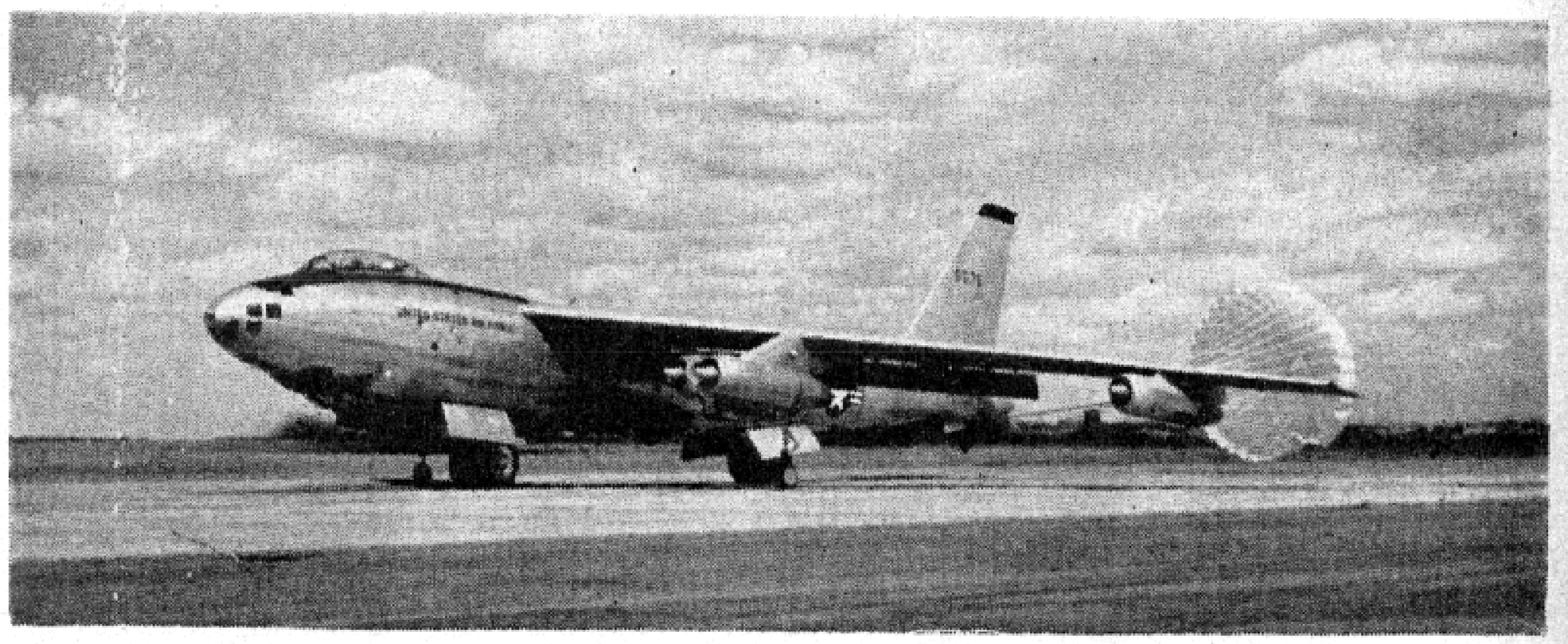
the speed class of the Stratojet. A new flexibility—an important and recent development—was worked out for the B-47 to absorb the bumps of high-speed flight, a sort of knee-action, so to speak, while the fuselage rides smoothly. In normal flight the wing tips deflect through an arc of 61 inches or over five feet. In static tests conducted by Boeing engineers, the wing was bent through an arc, the cord of which was 20 feet, with no permanent ill effect.

2

These few examples indicate the complexity of the B-47. The problems incident to these and other complex features of the airplane were researched, and the answers developed by people who are just like many readers of this magazine. One thing is certain—you never saw a prouder group of men in your life—proud of their work, their profession and their airplane. They feel they did just as much of a pioneering job in their field as some of our forefathers did when they came to the west in covered wagons. True, their task was not as rugged physically as that of our forefathers, but the mental drive to accomplish the desired ends was every bit as compelling, and the *fait accompli* every bit as thrilling.

A second factor which distinguishes the industrial scene of 1953 is the fact that its products are often marked with a large and unmistakable "RUSH". In the commercial field, such a pressure may come from competitive conditions; in defense work it arises from the urgent requirements of the Armed Services for the manufacture of its products on schedule. Time is a vital element; or as the military say, "Time is of the essence".

It has always been quite clear to the engineer that one cannot put a time clock on brain work and expect the best results. Original ideas are the product of thought processes which bear little or no relationship to time. One never knows when a new idea is to be born. While time is



(B-47 Parachute Landing)

A Boeing B-47 Stratojet sets down on the runway, its deceleration parachute aiding in slowing its speed. Boeing's Wichita Division is in quantity production of the Stratojets for the Air Force. Fastest known bomber in the world, the swept-wing B-47 has a top speed of more than 600 miles an hour. It is powered by six General Electric J-47 Turbojet engines, has a maximum gross take-off weight of 185,000 pounds and can carry more than ten tons of bombs. An earlier model, one of the original Seattle-built XB-47's flew across the nation at an average speed of 607.8 miles an hour in 1949, covering the 2,289 miles from Moses Lake in central Washington to Andrews Air Force Base in Marpland in three hours and 46 minutes. (BOEING AIRPLANE COMPANY PHOTO.)

important, the best ideas come without too much emphasis on time factors. The corollary is that compromised ideas frequently result from time pressure and thus are expensive stopgaps toward the ultimate or correct solution of a problem.

After the "let-down' in armament production following the last war, it was time itself that we had to buy back when the rearmament program began. This had its effect on both engineering and production. We found ourselves pressed for an accelerated production program that was to be effected concurrently with the development of the article being manufactured. This did not always permit the orderly incorporation or sequencing of complicated engineering changes as development progressed. These engineering changes nevertheless had to be made. They are still being made and they always will be made because of the dynamic nature of aviation. Changes, both in manufacturing and engineering, do, however, become less in number and magnitude as production and development programs stabilize, so ultimately they can be handled in a more orderly fashion.

A third factor to be reckoned with in considering the growing technical complexity of American industry in general and the aviation industry in particular is the engineering manpower problem. A survey of engineering schools shows that the composite graduating class for this year—the sum total of all engineering graduates from all engineering schools in the nation—will total about 22,000. There will be openings for an estimated 50,000 engineers according to current indications. The survey further indicates that the engineering graduate total will drop to 19,000 in 1954, increase to 20,000 in 1955 and then start a gradual upswing. It is perfectly apparent that the shortage of engineers is at this time critical, and for some time will be substantial.

In the case of our own company, when the Korean hostilities began, Boeing employed nearly as many engineers as at the peak of World War II, although its total factory manpower was only one-third as great. To express the same idea in a different way, there were 1,700,000 engineering manhours required for the first production model of the B-29 of World War II. For the B-47, the airplane we are now building at Wichita, the requirement was 3,446,000 manhours for the first production plane. And the B-47 manhour figure is being added to at the rate of 290,000 per month.

This trend is not peculiar to the B-47 alone. Every major aircraft company is concerned about it, particularly when its activties are as diversified as those of Boeing. In addition to the B-47 Stratojet, our company is building the KC-97 Stratofreighter tanker-transport, the

3

new B-52 Stratofortress heavy bomber, and is at work on a jet transport prototype. The plans are to have this new jet transport in the air by the summer or early fall of 1954.

Other Boeing projects, all of which engage the talents of many engineers, include Bomarc, the F-99 pilotless interceptor; lightweight gas turbine engines, an aerial refueling system, and an engineering study for the Air Force of the application of nuclear power plants to aircraft.

Another interesting problem with which the 20th century engineer is faced concerns the materials needed for all high-performance products. In aviation, the materials that sufficed for planes flying at the low altitudes and comparatively slow speeds of yesterday simply will not do the job as we progress into the transonic and supersonic speeds of tomorrow.

The details are so extensive that they can only be briefly outlined here. Most engineers in our industry realize that the major search at the moment is for metals with stability at high temperatures—metals that will give structural strength without bulk. The airplane designers must continuously work for maximum strength with minimum weight and bulk. They therefore find themselves from day to day dealing with and researching the application of new alloys and new methods of procedures in handling those alloys.

Consider temperature variation as an example; possibly most readers know that a jet-powered plane must get to altitude quickly since jet engines operate more economically there and are most uneconomical near the ground. Meeting temperature differentials from the ground to high altitude—any from 80 degrees plus at take-off to 65 degrees minus at altitude presents many problems in design and construction—problems that in themselves would be the subject of not one but many such articles as this.

From the factors just enumerated, and there are undoubtedly many others in other branches of industry, it is clear that the current character of American design and production is making new demands on its engineers and its management. How can these demands be met in an intelligent, resourceful way?

To formulate a successful and practical answer one consideration is basic. There must be continued emphasis on a carefully charted research and development program. In the technical age with which we are confronted we must be ever alert to the need for developing acceptable products that are practical and usable in spite of their complexity. This then emphasizes the need for long-term planning and

research so as to eliminate, as far as practicable, compromised answers to engineering and research problems

An example of one of Boeing's advanced or long-range planning projects is the F-99 Pilotless Interceptor about which our President William H. Allen recently said, "We are dealing with . . . we are devising . . . techniques never tried before . . . the horizons are virtually unlimited." This is a striking illustration of the need to look far ahead and plan on an organized basis. The interceptor is only one of a series of advanced projects being undertaken by my company.

Here is another example of how a company looks to the future and plans to keep in step with rapid technological development. Boeing owns and operates its own high-speed wind tunnel. It is located at our Seattle Division. The tunnel has been recently modified and modernized at a cost of $1,600,000 so it is now capable of testing models up to and beyond the speed of sound. The improved tunnel is the only privately owned one in the United States in which the effects of transonic speeds on research airplane models can be studied. Thus Boeing prepares itself for development work on the "faster" part of the "higher, faster, farther" requirements for aircraft for the future—long-term planning for research and development of aircraft products.

With all the complexities of engineering and manufacturing, and the new materials that must be utilized, the matter of costs becomes of vital concern. For all their amazing performance characteristics, airplanes to the extent possible must remain competitive in the bid for business in our enterprise system. We are working fervently at the problem. On this score, President Eisenhower has said: "Effectiveness with economy must be made the watch word of the defense effort—To protect our economy, maximum effectiveness at minimum cost is essential".

Another essential for an effective manufacturing operation today is the need for keeping tools and facilities promptly and fully abreast of the times. Management must ever be alert to this need. In our business, it should be perfectly clear that advanced aircraft cannot be fabricated without advanced machinery. Boeing, for example, in the years 1950, '51 and '52 authorized expenditures in an amount exceeding 22 million dollars for capital assets applicable to manufacturing needs and progress. It requires aggressive effort on the part of a manufacturer to stay competitive. He must continually improve the instruments and facilities for production. In addition, large Air Force investments have been made for machinery and improvements at government-owned facilities; all to the end that the modern high-performance

4

airplane can be built as accurately, as quickly and as economically as possible, all factors considered.

To illustrate the type of specialized equipment installed at Wichita for production of the B-47, one or two examples should be of interest. We have a Bertsch pincher-type bending roll on which both taper-milled and flat wing skin panels are formed to airfoil contour. This roll is normally used by shipbuilders in contouring steel plates for the sides of ships. It weighs 154 tons and the cost was $94,500 installed. There are three giant rollers on the unit—each 25 in. in diameter—which will handle wing skin panels up to 30 ft. long.

The 75S-T6 aluminum alloy used for wing panels on the B-47 has roll forming characteristics similar to spring steel. The wing skin is 5/8 in. thick at the wing root and tapers to a thickness of 3/16 in. at the wing tip.

Since no other airplane had ever approached the wing skin characteristics of the Stratojet, the giant pincher-roller was a necessary addition before B-47 production could begin. There are many other similar instances covering hundreds of machines and tools adapted or designed entirely by our own engineers. It was necessary to design and build over 60,000 jigs and tools for assembly and fabrication. There are 68,000 parts in each B-47; by comparison there are approximately 9,500 in a 1953 Cadillac automobile. It is readily seen that a big difference exists between automobile production and aircraft production—both as to quantities produced and units to produce those quantities.

In the midst of all this spectacular material progress, a reminder of "the human element" should not be amiss.

We must not lose sight of the fact that real wealth is the result of nothing else than human energy properly expended. In other words, real wealth results from personal effort.

The greatest need then is to understand people and to learn and know better how to work with people. Whatever is wrong with this world, that wrong is basically bound up with people. Management must therefore, in its effort to keep pace with material progress, also be ever alert to those human elements without the proper evaluation and consideration of which progress cannot be maintained on that broad human front so necessary to our combined well being.

For those who have just received engineering degrees, a word of caution might be added on another aspect of the human or personal

attitudes important to individual success in industry. Young engineers should be content to start with basic assignments; there is positively no substitute for practical experience in the field, in the shop or on the drafting board. Beginning technicians should be willing to start there and work up—putting the fundamentals of the craft into practical application for an appropriate period. After gaining on-the-job knowledge and experience young engineers are then in position to develop their specialty and build on a solid foundation. Youthful impatience with elemental, drafting-board assignments may be understandable, but is also to be discouraged. The urge to start at the top may indicate personal drive and enterprise, but it discounts the supreme importance of knowledge to be gained in no other way except by starting at the bottom, and working side by side with others who likewise seek their way to the top in a free competitive economy

FORMER SIGMA TAU PRESIDENT HONORED BY A.S.C.E

John C. Page, National President of Sigma Tau from 1938 to 1940 is one of four men to be accorded the highest honor of the American Society of Civil Engineers—election to honorary membership in the Society—officials of the Society announced.

JOHN C. PAGE

An induction ceremony will be held Oct. 21 at the Society's annual meeting in New York.

Page, a civil engineering graduate of the University of Nebraska, had a long career in the Engineering Division of the Bureau of Reclamation. He was appointed head of the division in 1935 and made a Commissioner of the Bureau the next year.

He was responsible for supervision of 60 reclamation and irrigation works, 165 dams and 28 power plants in the West. He retired in 1943 because of ill health but remained a consultant through 1947. He received the Department of Interiors highest honor, its Distinguished Service Award, in 1950.